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E.L. 42/71

RENISON BELL AREA - WESTERN TASMANIA

ANNUAL REPORT

1972 - 73

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INDEX

	Page No.
1. CONCLUSIONS AND RECOMMENDATIONS	1 - 2
2. INTRODUCTION	2 - 3
3. LOCATION, LAND TENURE AND ACCESS	3
4. PREVIOUS WORK	3 - 5
5. GEOMORPHOLOGY	5 - 6
6. GEOLOGY	6 - 10
6.1. Regional Geology	
6.2. Local Geology	
7. GEOCHEMICAL SURVEY	10 - 12
8. GEOPHYSICAL SURVEYS	12 - 13
8.1. General Discussion	
8.2. Turair Survey Results	
8.3. Magnetic Survey Results	
9. BIBLIOGRAPHY	31 - 32

APPENDICES

1. LIST OF TURAIR EQUIPMENT
2. TURAIR SURVEY EQUIPMENT AND PROCEDURES
3. ASSAY RESULTS FROM STREAM SEDIMENT AND ROCK SAMPLES
4. PETROLOGICAL DESCRIPTION OF ROCK SAMPLES

MAPS

1. and 2. LOCATION MAPS
3. INTERPRETATIVE GEOLOGY
4. GEOCHEMICAL SAMPLING
5. GROUND MAGNETIC SURVEY RESULTS
6. AIRBORNE MAGNETIC SURVEY CONTOURS
7. TURAIR-AIRMAG. INTERPRETATION RESULTS.

002
1. CONCLUSIONS AND RECOMMENDATIONS:

Detailed geological mapping, combined with both airborne and ground geophysical surveys, during 1972-73, succeeded in defining several anomalous regions within E.L. 42/71 which justify further exploration during 1973-74. These anomalous regions lie both within Area 1 and Area 2. of the licence area.

It is recommended that during 1973-74, the anomalous regions be further explored by way of ground magnetometer, I.P., (both E.I.P. and M.I.P.), geochemical soil sampling and detailed geological mapping surveys.

In more detail, Area 1: (N.W. of Renison Bell) There are two regions within Area 1 which require further attention. viz. (a) that geophysically anomalous area around the Pieman River Road-Dunkley Tram Road Junction and (b) a region in the south of Area 1 which an earlier airborne magnetic survey showed to be anomalous.

Anomaly (a) is geologically similar to the Renison Bell Mine area. It is magnetically anomalous but Turair responses were small. It is already covered by traverse lines, and the only work recommended for 1973-74 is geochemical soil sampling and a restricted I.P. survey.

Anomaly (b) is an area of Cambrian and Precambrian sediments. An airmag. survey by Aberfoyle in 1964 defined a large low order anomaly in the area. Work recommended in 1973-74 includes establishing a series of cut traverse lines over the airmag. anomaly and completing ground magnetic and geochemical surveys on these lines.

Area 2 (S. of Renison Bell). Several Turair and Airmag. anomalies were defined in the Northern section of this area during 1972-73. Most of this area is already covered by cut traverse lines, on which an I.P. - S.P. -resistivity survey has been completed, together with some drilling. In addition to a re-evaluation of the results of these surveys, it is recommended that a proton magnetometer survey be undertaken over these traverse lines. The remainder of Area 2 should be mapped in detail.

2. INTRODUCTION:

The main exploration targets on E.L. 42/71 are tin bearing Renison type orebodies (ie) tin bearing sulphides, although there is also some potential for locating Ag-Pb-Zn orebodies also.

Exploratory work prior to 1972-73 confirmed that the stratigraphic succession on E.L. 42/71 was generally similar to that of the Renison mine area, and further encouragement was obtained by way of geophysical and drilling programs which located significant amounts of tin bearing sulphides and defined several restricted areas which warranted further work.

During 1972-73, an airborne E.M.-magnetic survey was flown over much of the area, and detailed geological mapping and proton magnetometer surveys commenced on selected areas on the ground. This work confirmed and extended previous knowledge. The direction in which future work should progress is now fairly clear.

Recommendations for 1973-74 include further detailed ground geophysical, geochemical and geological surveys in several area within E.L. 42/71. These surveys should be sufficient to then define drilling targets in subsequent years.

3. LOCATION, LAND TENURE AND ACCESS: (See Maps 1 and 2)

In April 1973, E.L.42/71, S.P.L.117, and S.P.L.27, which were all held by Renison Limited, were amalgamated into one licence area viz. E.L.42/71. S.P.L.27 was reduced in area at the time of the amalgamation.

E.L.42/71 was granted in two parts - Area 1 lies 1 km. north-west of Renison Bell and Area 2 lies 2 kms. south of Renison Bell. Both areas combined cover 41.5 sq. kilometers.

Access to Area 1 is by 4-wheel drive road either from Renison Bell or from the Argent Dam, and these roads are supplemented within the area by the Dunkley Tram Road and numerous, but not always trafficable, logging tracks.

Area 2 can be reached either from the North-East Dundas Tram Road or the Pine Hill-Commonwealth Hill Road.

On both areas, there already exist cut traverse line systems which aid access in places.

4. PREVIOUS WORK:

Within Area 1, silver-lead mineralisation was located in the Crimson Creek area by Owen Meredith in 1890. The Owen Meredith and Success Mines were worked from 1890 - 1895, with the Success Extended Mine being re-opened from 1912 - 1917.

Total production from these mines was not recorded but was of the order of 100 tonnes of Pb and 1000 kgs. of Ag.

Within Area 2, two small mines, the Kapi, and Melba Mines, produced small amounts of Ag-Pb ore between 1890 and 1900. The Kapi Mine is thought to have produced 18 tonnes of Pb, and 125 kgs. of Ag whilst the Melba produced approx. 65 tonnes of Pb and 250 kgs. of Ag.

Asbestos fibre was discovered on Serpentine Hill during construction of the Zeehan-Renison Bell Road but the only production recorded was 352 tonnes of fibre produced between 1943-45.

In 1950, North Broken Hill Limited investigated the Crimson Creek Area but the result of their work is unknown. In 1954, the Tasmanian Mines Department cut a grid over the Dunkley Town - Success Extended Mine area and conducted geological and geophysical (E.M. - S.P. and magnetic) surveys over the grid.

In 1958, the Tasmanian Mines Department drilled one hole to test the Melba and two holes to test the Kapi Mines but results were discouraging.

In 1963, Comstaff Pty. Limited acquired Area 1 of E.L.42/71 as part of E.L.5/63. They worked intermittantly on the area up to 1970 and in this period, they cut traverse lines and undertook mapping, geochemical, geophysical (I.P., S.P., magnetic), costeaning and drilling programs. In the Dunkley Town area, they drilled three holes totalling 764m. to test a gossan over a strike of 500m. The results were discouraging.

In 1965, Aberfoyle Limited covered the whole E.L. 42/71 area with regional airborne magnetics.

In 1967, Area 2 of E.L.42/71 was granted to Renison Limited as part of S.P.L.27. From 1967-1972, detailed ground work in the form of geological mapping, geochemical and geophysical surveys was undertaken. Three diamond drill holes (S277, S283 and S284) were completed. The results of S283 and 284 are regarded as encouraging.

In 1972, E.L.42/71, which covered the western half of the current Area 1 of E.L.42/71 was granted to Renison Limited. The Dunkley Tramway was opened up as a roadway and mapping and geochemical surveys were completed in selected areas.

In 1972, the eastern half of Area 1 of E.L.42/71 was granted to Renison Limited as S.P.L.117 and detailed mapping and airborne E.M.-magnetic surveys were completed over the area.

All significant reports referring to the licence area are listed in the bibliography at the end of this report.

5. GEO MORPHOLOGY:

Within Area 1, several geomorphological areas can be recognised, each related to the underlying geology. Precambrian quartzites and slates outcrop in the north in areas of high relief. Resistant quartzites form ridges but shale beds are usually deeply eroded and thus become river channels (eg) Crimson Creek. In the Dunkley Area, wide swampy plains are developed over the slates with occassional low quartzite ridges. Soft Cambrian sediments lie east of the Precambrian units.

They are deeply dissected by major dendritic and linear drainage systems and support thick myrtle forests. Fluvioglacials overlies the Cambrian rocks and generally form flat areas covered by thick ti-tree and baura scrub.

In Area 2, geology does not appear to have the same control on geomorphology, and no consistent influences have been recognised.

6. GEOLOGY

6.1. Regional Geology:

Precambrian rocks (Donah Quartzites and Slates) outcrop to the west and south west of Renison Bell. They are overlain to the east by argillites and tuffs of the lower Cambrian Crimson Creek Formation. These in turn are overlain by the middle Cambrian Dundas Group sandstones, shales and conglomerates both to the south and east of Renison Bell.

Silurian and Devonian sediments of the Zeehan area are represented in the southern part of Area 1.

The Cambrian and Precambrian formations have been intruded by middle-upper Cambrian ultrabasic-basic bodies and by upper Devonian granite.

Pleistocene fluviglacials overlies some of the older rocks between the Pieman River and Renison Bell.

6.2. Local Geology: (See Map 3)

Detailed discussion of the local geology will be confined in this report to Area 1 as the geology of Area 2 has already been described in the Renison Limited report:

508

"Asbestos Potential of the Razorback and Serpentine Hill Ultrabasics" by P.B. Brophy, Oct. 1972 (Unpub.). The oldest rocks represented in the area are the Precambrian Oonah Quartzites and Slates, whose total thickness must be greater than 500m. They consist of basal quartzites and siltstones which grade upwards into shales and carbonates.

The basal quartzites are thickly bedded gray to gray-green saccharoidal micaceous quartzites with minor interbedded fine grained argillaceous siltstones. They weather to soft friable sandstones with light gray sandy soils. Near the top of the quartzites are beds of brown argillaceous siltstone, similar in appearance to Cambrian argillite but more micaceous.

Conformably overlying the basal quartzites is a sequence of black shales, dark gray siltstones and carbonates. Their total thickness is approx. 200m., and are similar in appearance to the Renison Bell Member at Renison Bell. Along the Dunkley road near Dunkley town, slumping in the shales is regarded as prediagenetic. A thin carbonate bed near the shale base outcrops near the Poseidon and Murchison Mines and may be equivalent to the Renison No.3 Horizon. A carbonate derived gossan outcrop along the Pieman River road near the top of the shale-siltstone sequence and this may be equivalent to the Renison No.2 Horizon.

The Oonah sequence appears to have been folded into a N.W.-S.E. series of domes, which thus have highly variable dips. This effect may be the result of a system of E.-W. folds being superimposed on a series of N - S folds.

009

Intense metamorphism was not observed.

Conformably overlying the Onah Quartzites and Slates, in Area 1 is a 3000m. (plus) sequence of argillites, cherts and lithic tuffs of the lower Cambrian Crimson Creek Formation. The Precambrian-Cambrian boundary position is debatable, but is regarded here as the base of chert bed which occurs beneath the argillites and tuffs. Rocks below this chert are mainly clastic sediments (quartzites, shales and carbonates) whilst those above and including the cherts contain a high volcanic component.

The basal cherts were probably deposited from silica rich waters associated with nearby volcanism. They consist of 10 - 20m. of red or pink cherts, nodular cherts and pelletal clays and carbonates. Outcrops of chert are rare and their presence is inferred by the occurrence of quartz scree extending north-west from Dunkley town to the northern licence boundary. They may be equivalent to the Renison Red Rock Member. Conformably overlying these basal cherts is a thick sequence of interbedded argillites and tuffs. The gray and gray-green lithic tuffs contain pyroclastic fragments of andesine, anorthite, magnetite, glass, serpentine, trachyte and carbonate set in a fine grained altered ground mass of argillite and ash. Onion weathering of the tuffs on the ridges is common. The ash is often altered to chlorite. The argillites are purple to red-brown, fine grained, massive, indurated mudstones with some shaly horizons. They weather to thick brown & yellow clays.

010

Carbonate occurs throughout the sequence in small amounts as carbonate rich beds or as disseminated grains. Mica (muscovite) occurs along bedding planes but is not as abundant as in the underlying Precambrian rocks.

The Crimson Creek Formation generally dips 40 - 70° to the north-east but more variable dips do occur in areas of complex folding such as at Dunkleytown.

In the south of Area 1, Silurian-Devonian Florence Quartzites, Keel Quartzites and Austral Creek Siltstones outcrop and form the N.W. - S.E. trending east limb of a large upper Palaeozoic syncline.

Upper Cambrian microgabbro sills (?) and an upper Devonian quartz porphyry dyke intrude the Cambrian sediments and volcanics in Area 1. The microgabbros are composed of oligoclase laths, augite, leucogenised iron oxides, and secondary chlorite. Small vesicles are filled with secondary chlorite and carbonate. Serpentinous material occurs in small patches, possibly replacing olivine crystals. Scattered outcrops of microgabbro were located, and suggest several dyke or sill intrusions, and they appear to be related to microgabbro dykes north of E.L.42/71 near the Pieman River and south of E.L.42/71 on the Renison Mining Lease.

A small outcrop of weathered quartz porphyry dyke was located in the north-east section of Area 1, on the Pieman River Road. It may be related to similar dykes which radiate from the Pine Hill intrusion on the Renison Mining Lease.

Mineralisation within Area 1 consists of argentiferous galena in the Poseidon-Dunkleytown and Success Creek areas, disseminated sulphides in the basal Crimson Creek cherts and microgabbros, and gossanous material along the Pieman River Road.

In the Poseidon-Murchison mine area, silver lead mineralisation occurs as a partial replacement of a flat lying carbonate bed, which may be the lateral equivalent of the Renison No.3 Horizon. The carbonate has been altered to an ankerite marble. Argentiferous galena was also produced from the Success Extended and Owen Meredith Mines where galena, pyrite, chalcopyrite and sphalerite occurred in a fault, up to 1.5m. wide, within the Crimson Creek Argillites. Production was approximately 600 - 700 tonnes of ore grading 15% Pb and 1800 gms Ag per tonne. Minor disseminated sulphides were found in the basal cherts and microgabbros.

An extensive gossan outcrop in the Dunkleytown area was traced eastwards to the eastern licence boundary. The gossan is manganiferous cryptomelane, developed on a carbonate bed which is probably the lateral equivalent of the Renison No.2 horizon.

7. GEOCHEMICAL SURVEY:

Little geochemical sampling was undertaken in Area 1, as most of the northern area was soil sampled by Comstaff in 1968-70 and most of the southern half was stream sediment sampled by Renison in 1971-72.

No geochemical work was undertaken in Area 2. Only five (5) stream sediment samples were taken and the results of these samples are tabulated in Appendix 3. The pH values of streams in the northern part of Area 1 were recorded, and all lay in the range 5.5 - 6.0. Gossans, carbonates and sulphide bearing rocks in Area 1 were sampled and assayed for Cu, Pb, Zn, Ni, Sn, As, Co, Ag, Mn, Fe, Mg, Ca and S.

Their results are presented in Appendix 3. Several anomalous analyses were obtained and are discussed below:

Rock sample locations are shown on Map 3.

Copper: Two samples (3c and 115) were associated with a carbonate bed near the Cambrian-Precambrian boundary. Both assayed 500ppm. Cu.

Lead: Samples 1b, 1c, 1d, 249 and 286 were regarded as anomalous for lead. Samples 1b, 1c and 1d are associated with possible No.3 horizon mineralisation at the Murchison Mine.

S249 was a gossan associated with Red Cherts near Crimson Creek, whilst S286 came from the gossan developed on the carbonate bed on the Pieman River road. Two samples of both S249 and S286 were taken and both gave widely varying results (see Appendix 3).

Zinc: Samples 1b, 1c, 249 and 286 were anomalous. Remarks concerning 249 and 286 for lead, also apply for zinc.

013

Tin: All gossans sampled were high in tin (500-1700 ppm.). Other anomalous samples were 228 (900 ppm) 251 (900 ppm), 268 (1100 ppm), 291 (1200 ppm). All these samples were associated with No.2 - No.3 horizon type of mineralisation in a banded siltstone-shale sequence, except for 268 which came from the Argent River, which may have been contaminated by tailings in the River.

Arsenic: Sample 249 (1500-2300 ppm) was associated with mineralisation in the Owen Meredith-Success area.

8. GEOPHYSICAL SURVEYS:

8.1. General Discussion:

Prior to 1972-73, various companies have undertaken both airborne and ground geophysical surveys over parts of E.L.42/71. The value of much of this work has been lost because one survey has rarely been related to previous surveys. considerable effort is currently being devoted by Renison Limited to the collection and recompilation of much of this previous data over E.L.42/71. At the same time new airborne and ground surveys are being undertaken on both Areas 1 and 2.

During 1972-73 an airborne E.M.-magnetic survey was undertaken over portions of Area 1 and 2, and a ground magnetic survey was commenced over the north-eastern part of Area 1.

Several anomalies were defined by these surveys and further follow up work is recommended.

The sections on the airborne geophysical surveys presented below are taken directly from reports by consultants involved with the work. Their full reports are not presented here as they refer to areas other than E.L.42/71.

8.2. Turair Survey Results:

The results of the turair survey presented here are taken in their entirety from:

"Report on Turair Airborne Electromagnetic-Magnetic Survey, Renison Bell-Mt. Lindsay Area, Zeehan, Tasmania, on behalf of Renison Limited" by J.G. Linford, of Scintrex Pty. Limited, dated May 1973.

The recommendations are therefore Linfords.

COMMENCEMENT OF SCINTREX REPORT:

1. SUMMARY

Anomalous responses have been analysed for depth, conductivity - thickness and magnetic correlation. Many of these have high conductivity and direct magnetic correlation, being indicative of massive pyrrhotite bodies. Several flat lying bodies are evident. Other conductors with low conductivities but with magnetic features, probably relate to the Renison Bell shales.

Detailed ground follow-up is recommended on a selection of anomalies.

Equipment details are attached in Appendix 1 and a general discussion of the Turair method is presented in Appendix 2.

2. PRESENTATION OF DATA

The original data records are presented in two binders, the data being recorded on a 6 channel, heat sensitive strip chart recorder and operated at a speed of 10 cm per minute. The chart is 38 cm wide with each channel being 5 cm wide. The parameters recorded and their details are as follows:

Altimeter: The altitude of the helicopter above the ground is recorded in an analog form where approximately 1 cm = 30m. The E.M. bird is 30m. below the helicopter. Calibration records of the altimeter are presented in the binder.

Amplitude: The amplitude of the signal output from the preamplifiers is recorded in analog form. It shows the automatic switchings that occur to keep the signal within the necessary amplitude range for the equipment operation.

Electromagnetic: The sensitivity of the Turair records are as follows:

Field strength ratio (FSR) 1 cm = 1%
Phase difference 1 cm = 0.50 degrees.

Magnetometer: The magnetic data is recorded on two channels, a detailed channel with full scale deflection (FSD) of 100 gammas, and a second channel with FSD of 1000 gammas.

The fiducial marks are recorded on the event markers, the intervals being 1.6 seconds.

The flight log records are presented in a separate binder, and show the lines surveyed and which lines were recovered.

The survey flight lines and points recovered are shown on the 1 : 10,000 photographs, the points being recovered with the aid of the on-board tracking camera. Because of the photographic distortion, the flight path recovery was transferred to the controlled topographic plans of the area.

Map 2 , shows the Turair anomalies while
Map 4 , presents the aeromagnetic contour plan.

INTERPRETATION

The electromagnetic records are interpreted to determine the presence of conducting bodies and to obtain some information relating to their character. The intervalometer time marks are synchronized with the positioning camera film strip and thereby permit the relating of the conductors with approximate ground locations. The terrain clearance is obtained from the altimeter data.

Normally, a plan is prepared, either using a subdued photomosaic or an overlay from a mosaic or topographic plan as base. The flight path of each survey line is obtained by means of "tie points", which are features on the mosaic film. The flight path is interpolated between these tie points.

Where field distortion occurs the curves indicate the location and the depth of the main current flow. The "current axis" is well defined when the current is concentrated, for instance, in thin, steeply dipping conductors. In wide, banded conductors, or in horizontal conductors, the current is usually more dispersed and the anomalies yield less positive information.

(a) Peak Location

The peak location of the amplitude ratio using the horizontal coplanar coils is shown on the plan by a circle in the appropriate location. In the case of broad conductors or closely spaced multiple conductor zones there may be more than one peak, in which event all major peaks are shown. A conductor which is likely man-made is indicated by an X rather than by a circle.

As a rule the current axis is located right below the maximum field strength ratio deflection or the maximum phase anomaly. The depth under the traverse is indicated by the shape of the anomaly.

(b) Depth and Conductor Width

The "Half width", i.e. the distance between the points of half the maximum response amplitude is, for simple line current sources, approximately equal to the depth of the source under the detector. Flat-lying conductors characteristically give rise to very large half widths, combined with rather irregular curve shapes.

Here the half width may reflect the conductor width rather than the depth and the latter can usually not be determined. In cases where the conductivity zone is interpreted to have indicated on the plan by an open bar symbol along the flight line. Well defined peaks within this zone should be marked, and if possible interpreted as individual anomalies. The subsurface depth of the current axis (subtract detector altitude) is marked below the peak location circle.

(c) Conductor Grading

Field strength ratio and phase differences anomaly amplitudes are dependent on the overall geometry as well as on target size and σt value. Their primary significance is in the degree of certainty they lend to detectability and quantitative interpretation. For the purpose of amplitude grading three categories are used: Category 1, fully shaded, greater than 100 mhos; Category 2, half shaded, between 10 and 100 mhos; and Category 3, unshaded, less than 10 mhos. (See Appendix 2).

(d) Conductivity-Thickness Factor

The field strength ratios and phase differences provide a measure of the conductivity of the conducting bodies, i.e. good conductors are characterized by field strength distortion combined with relatively little phase shifting, whereas poor conductors affect the phase rather than the strength of the resultant field.

For an accurate grading the conductivity-thickness factor (σt value) of individual conductors can be derived from the calculated in-phase and out-of-phase components, taking into consideration the exciting frequency and the strike length of conductor. The σt value is then marked below the peak location circle, and next to the depth.

Large, highly conducting bodies such as massive sulphides or graphite and seawater, etc., generally have high σt values. Moderate conductors will have σt values between 10 and 100 mhos. Poorly conducting bodies (e.g. most overburden and some sulphide and graphitic zones) will have σt values of less than 10 mhos. In areas where there is a clear differentiation in conductivity between the targets of potential economic interest and other possible conductors, the σt values may form the main basis for discrimination. When the conductivity ranges of economic and non-economic overlap, the σt value cannot, of course, be rigidly relied upon.

(e) Current Pattern

To obtain the projection of the current pattern, the anomalies are connected between lines, using depth σt values and other characteristics of the curves as criteria. The strike of the formation, if known, is also taken into consideration.

20
(f) Magnetic Correlation

With magnetic data available, any correlating magnetic expression is noted for the pertinent conductor peak. A conductor peak with direct magnetic correlation is indicated by a double concentric circle.

Location of a conductor on the flank of a magnetic anomaly is indicated by means of one half of a concentric circle on the side of the magnetic high.

The significance of direct or flank correlation depends on the search problem. In the former case the magnetic and conductive properties may be coincident or belong to two narrow adjoining zones. In the latter case the conductor may be located at the contact of a wider magnetic formation.

DISCUSSION OF RESULTS

Each electromagnetic anomaly being given a code number, is analysed where possible, for the following:

1. Location
2. Anomalous field strength ratio in percent.
3. Anomalous phase difference in degrees.
4. Relevant magnetic character.
5. Depth estimation of current axis below the ground.
6. Correlation of anomalies on adjacent lines, being indicated by a common conductor.
7. Conductivity-thickness (σt) product.

U21

The fiducial position of the anomalies as shown on Map B. is taken directly from the geophysical data with no adjustment taken into account for any displacement from its true position. A displacement of 30 to 60m often occurs, normally in the direction of flight.

The noise level of the system is generally taken as about 0.1 percent and 0.1 degrees. There is little geological or instrumental noise. Most of the anomalies are several times the noise level and are often particularly well-defined.

The recorded terrain clearance of the helicopter varied between 60 metres and 160 metres, because of the mountainous terrain.

A number of the distortions indicates a flat lying body with which the inducted current flows in a loop or cell. In many cases more complex distortions are shown.

In evaluating the anomalies, those anomalies having a high conductivity and a magnetic anomaly have a high priority, indicating probably massive pyrrhotite. Anomalies with a magnetic correlation but low conductivity probably relate to shales, but could be non-interconnected massive sulphides. Flat lying conductors with magnetic features are also of interest.

Anomalies 2 and 3 define Conductor 1. The anomalies are weak and indicate a probable westward dip. The conductor is near the east contact of a 200 gamma high and has a depth of 50m. and a very low σt . Of minor interest.

022

Anomalies 7, 8, 9, 10, form a broad conductive region - a flat-lying Conductor 2. Some of the anomalies show current cell characteristics and localized distortions.

Anomalies 91 and 93 relate to a broad weak FSR distortion. Of little interest.

Anomaly 104 is a well-defined FSR anomaly, but with no magnetic feature.

The grading of the anomalies and conductors is summarized below:

Of interest:

Conductors:	None
Anomalies:	None

Of secondary interest:

Conductors:	2
Anomalies:	None

Of minor interest:

Conductors:	1
Anomalies:	4, 104

CONCLUSIONS AND RECOMMENDATIONS

Anomalous electromagnetic responses have been analysed and interpreted where possible, for depth, conductivity-thickness and magnetic correlation.

The depths are occasionally quite variable, but this is mainly due to the weakness and error in the anomalous half-widths, and to a lesser extent, the variable helicopter speed.

Similarly, conductivity-thicknesses cannot always be determined. Flat lying bodies yield less detailed information.

In view of the early geophysical drill core work and the known geology, three characteristic anomalous responses are expected: Highly conducting and magnetic bodies due to fractural lodes of pyrrhotite; poorly conducting and magnetic bodies due to shales; large flat lying bodies due to structural lodes of pyrrhotite. A number of such bodies can be interpreted. In the grading of the conductors in the Discussion of Results, the general definition and quality of the anomaly is considered, as well as the case that a massive sulphide body may not be interconnected to form a continuous conducting body, and hence is indistinguishable from a shale body. Also a number of highly conducting bodies, often isolated, but with no magnetic anomaly, are upgraded.

Although the grading given should be followed, the following are likely pyrrhotite and shale bodies:

Pyrrhotite bodies:	Conductors:	2
	Anomalies:	None
Shale bodies:	Conductors:	None
	Anomalies:	4

As an initial follow-up procedure, all available Geological and geochemical information should be used to correlate and evaluate these anomalies and conductors. Favourable geology, could significantly upgrade a conductor.

The follow-up procedures which are usually given for most Turair surveys are listed below:

1. Comprehensive geological evaluation of the electromagnetic anomaly environment, perhaps including geochemical sampling.
2. All mainly FSR anomalies to be defined by ground electromagnetics.
 - a) For shallow sources (less than 100 ft.) horizontal or vertical loop.
 - b) For deeper sources, the Turair technique should be used.
3. All mainly phase anomalies should be defined on the ground by induced polarization.
4. Any drilling thought warranted, should be based on ground geophysics. No drill hole should ever be spotted on the basis of the airborne data alone.

END OF SCINTREX REPORT

CONCLUSIONS AND RECOMMENDATIONS by L.A. Newnham

The Turair-magnetic survey flown should have obtained anomalous responses over Renison type orebodies if they existed in the area.

E.M. responses similar to those obtained over the Renison mine were not repeated on E.L. 42/71. The magnetic results however appear more encouraging.

Twenty one (21) E.M. anomalies were outlined, mostly of a low order magnitude. These should be followed up on the ground.

8.3. Magnetic Survey Results:

8.3.1. Airborne Magnetic Survey:

An airborne magnetic survey was flown in conjunction with the Turair survey by Scintrex Pty. Limited. The results were contoured by Scintrex (see map 6) but the interpretation was by Compagnie Generale de Geophysique (see map 8).

The results of the airmag. interpretation presented here are taken directly from:

"Interpretation of a Helicopter Borne Magnetic Survey over the Renison Bell Area" by G. Omnes, August 1973, Compagnie Generale de Geophysique.

COMMENCEMENT OF C.G.G. REPORT:

1. GENERAL CONDITIONS:

The magnetic dip, i , in the Renison region is 72° . The shape of the anomaly due to an east/west magnetic body depends on i . For bodies which do not have an east/west trend the shape of the magnetic anomaly depends on the apparent inclination, i' , defined as follows:

$$\tan i' = \frac{\tan i}{\cos \psi}$$

where ψ is the angle between the magnetic meridian and a plane perpendicular to the anomaly. In this case ψ varies between 0° and 90° . Therefore i' varies between 72° and 90° .

Provided the remanent magnetisation is negligible and the dips of magnetic bodies are vertical or nearly vertical the anomalies of the total field are symmetrical positive anomalies ($\psi = 90^\circ$) or dissymmetrical anomalies which comprise a positive arch and a much smaller negative arch, the negative arch being located on the southern side of the body.

A dyke-like body which has a dip differing from the vertical by ρ degrees gives rise to an anomaly which has the same shape as if the apparent inclination was $(i' + \rho/2)$ instead of i' .

East/west faults give rise to mainly positive anomalies when the magnetic block is thrown upwards on the southern side and mainly negative anomalies when the magnetic block is thrown upwards on the northern side.

The orientation of the magnetic bodies has an influence on the amplitude of anomalies. The amplitude is proportional to

$$M_t = \frac{\sin^2 i}{\sin^2 i'}$$

In the present case M_t varies between 0.95 and 1.00.

All quantitative interpretations have been carried out assuming that the remanent magnetisation is negligible, i.e. $I = k \times T$ (I : magnetisation; k ; susceptibility; T : total field). Bilogarithmic master curves were used for all calculations*

The determination of geometrical dimensions is not affected by the remanent magnetisation but the determination of dips and of the magnetisation 'I' may be strongly affected.

Magnetisation indicated on interpretation plates are Apparent Magnetisations and dips are hypothetical.

*See "Interpretation of gravimetric and magnetic anomalies" by J. Chastenot de Gery and H. Naudy, 12th Meeting of the European Association of Exploration Geophysicists - Brussels - June 1957.

2. EXPLANATION OF LEGEND

 positive and negative axes : an anomaly may have a positive axis, a negative axis or a positive axis and a negative axis. Positive and negative axes coincide respectively with maxima and minima on anomalies due to a single magnetic body. On complex anomalies some positive axes indicate the position of the maximum as it would be if there were no interferences from stronger anomalies.

It is not always possible to determine the number of elementary anomalies interfering in a complex anomaly. Therefore, the number of positive axes or negative axes represents the minimum number of magnetic bodies.

$I_1 \int I_2 : I_1 \int I_2$: limits of magnetic bodies. Hatchings are on the side of the higher magnetisation. It is possible to determine the width of a magnetic body if the width is not smaller than the distance between the sensor (i.e. ground clearance + depth below surface) and the top of the magnetic body, otherwise only the product "width x magnetisation" can be calculated.

For some particularly complex anomalies, where limits between magnetic bodies cannot be determined, only the outer envelope of the complex magnetic bodies has been indicated. For narrow isolated magnetic bodies only the axis has been indicated.

δ : dip; as specified above dips have been determined assuming that the influence of remanent magnetisation is negligible.

$I = 400$: magnetisation in gammas. Only the Apparent Magnetisation can be determined because the Remanent Magnetisation is unknown. The relation between the magnetisation I , the magnetic susceptibility k and the total field T is $I = k \times T$.

The magnitude of the Apparent Magnetisation gives a rough idea of the magnetic material content and consequently of the nature of the magnetic body.

- pyrrhotite mineralisations: the interpretation of ground measurements * showed that the Apparent Magnetisations of the known pyrrhotite lodes is sometimes as low as 200 gammas and generally does not exceed 1000 gammas.
- ultramafic bodies: magnetisations are very variable. Generally they are within the 50 - 1000 gammas range, but they are occasionally larger than 1000 gammas.
- Banded Iron Formations: these formations may be strongly magnetic, with magnetisations as high as 5000 - 10000 gammas. The interpretation of

029

the aeromagnetic survey flown by C.G.G. in 1971 west of Renison showed that some Banded Iron Formations have Apparent Magnetisations of about 2500 gammas (see "Interpretation report for Consolidated Syndicate of the Queenstown Aeromagnetic Survey").

* See "Interpretation of vertical component magnetometry at Renison (Tasmania)" - C.G.G. 1972.

- granite, sediments: the magnetisations of ordinary sediments (quartzite, schists, limestones) and granite are lower than 50 gammas. High sensitivity measurements are needed for detecting magnetic contrasts between these formations.

$h \approx 180m$: depth of the top of the magnetic body below surface

 : magnetic discontinuity indicated by interruption of magnetic axes. Magnetic discontinuities generally coincide with faults.

$2a = 400m$: width of magnetic body

2. INTERPRETATION:Anomaly HM 14

$2a \times I = 13,000$ gamma-metres (36W) $h = 30m$.
 HM 14 is an isolated anomaly located along a geological contact, perhaps at a footwall of Cambrian argillites overlying Precambrian formations.

There is no Turair anomaly.

Anomaly HM 15

$2a \times I = 130,000$ gamma - metres on traverse 5E.
 This figure was obtained by comparison with a bilogarithmic master curve, whereas measuring the area * of the anomaly on 5E gave:

$$2a \times I = 125,000 \text{ gamma metres } h = 80m$$

* If S is the area of an anomaly : $2a \times I = 0.25$

The product $2a \times I$ is higher than on any other anomaly due to a known mineralisation but the lateral extension of HM 15 is small. On 4E and 6E the area of the anomaly is only 30,000 gamma-metres. There is no Turair anomaly but the magnetic body is deep and penetration might have been reduced by shallow conductor described above.

According to a Renison Limited geological map of the Pine Hill - Razorback area, HM 15 coincides with or is located near a serpentinite body situated between the Melba Spillites and the Cambrian argillites.

HM 15 can perhaps be identified with anomalies M 30 and M 34 of the Pine Hill ground magnetometry grid (see C.G.G.'S report "Interpretation of Vertical Component Magnetometry at Renison (Tasmania)" 1972 - Renison Limited)

3. CONCLUSIONS AND RECOMMENDATIONS:

In the Renison Bell - Pine Hill area anomalies coincide with all known mineralisations. One strong anomaly does not coincide with known mineralisation. This is HM 15 near Pine Hill, and it does not coincide with a Turair anomaly. At HM 15 the magnetic body is about 80 metres deep.

For the first ground follow up programme we recommend surveying Anomaly HM 15 - the exact location should be checked on the mosaic. It is perhaps due only to a serpentinite body.

END OF C.G.G. REPORT.

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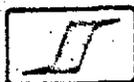
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SCINTREX PTY. LTD.



GEOPHYSICAL CONSULTANTS AND CONTRACTORS

APPENDIX I

LIST OF TURAIR EQUIPMENT

A. AIRBORNE EQUIPMENT

<u>Description & Scintrex Model</u>	<u>Wt. Lbs.</u>	<u>Brief Specifications</u>
Turair Console TAR-II	15	POWER: 20 to 30 V.D.C., 400 mA. INPUT: Preamplified 400 or 200 Hz sine wave from bird. OUTPUT: A. Signal amplitude, meter display and Recorder output. B. Amplitude ratio in percent, meter display and recorder output. C. Phase difference in degrees, meter display and recorder output.
Turair Bird Cable Assembly TAR-II	125	POWER: + 15 V.D.C. supplied by Turair Console through tow cable - 2 preamps. INPUT: Induced EMF from two horizontal coplanar coils, 1 μ V to 1mV., sine wave. GAIN OF PREAMPS: AV = 1000 OUTPUT: Sine wave to shielded conductor in 100 ft. tow cable.
Magnetometer Console MAP-2	12	POWER: 24 to 30 V.D.C., 3.2A Max. INPUT: Precession signal from sensor coil. OUTPUT: Total magnetic field intensity in three forms. (1) Digital display, 5 figures. (2) Digital binary coded decimal 5 decimal places. (3) Analog, 5 V. full scale. Choice of 1000 γ full scale or 100 γ full scale. SAMPLING RATE: Once per second. ACCURACY & SENSITIVITY: ± 1 gamma. optimum

036

Magnetometer Sensor 771 021	18	POWER: 3.0A energizing pulse applied to double coil for 660 msec. OUTPUT: Precession frequency from kerosens atoms within coils.
Positioning Camera VINTEN MK III (12v)	13	INPUT: 12 V.D.C. pulses from intervalometer. FUNCTION: Camera shutter and film advance actuated once every 1 to 4 sec. to take an aircraft positioning photo.
Turair Recorder MFE 6 Channel	39	POWER: 115 VAC 60 Hz 250 VA INPUT: Analog voltage representing 1) Signal amplitude 2) Amplitude ratio 3) Phase angle 4) Altitude above ground 5) Magnetometer 100% FS and 6) 1000% FS and fiducial marks OUTPUT: Excepting fiducials all information recorded in analog form
Intervalometer EIA-5	2	POWER: 24V DC FUNCTION: Provide DC pulse to operate positioning camera at intervals variable from 1 sec. to 4 sec. Simultaneously provides voltage pulses to operate fiducial counters and fiducial marks on recorder event markers.
Inverter Flite- tronics PC-16	16	INPUT: 28 V.D.C., 10 to 14 amps. OUTPUT: 115 V.A.C., 250 VA FUNCTION: Provides power source for recorder.

Radar Altimeter		POWER:	9 to 30 V.D.C., 1.0 amp.
In-Flight Devices	2	OUTPUT:	Direct readout of altitude above ground level in the range 80 ft. to 3000 ft. Also provides warning if aircraft drops below a pre-set height-above-ground.
GAR or			
BONZER VME		BONZER POWER:	12 or 28 volts DC 0.5 amp Meter readout 80-1000 ft.

Helicopter Intercom		POWER:	24v DC.
Set	2	FUNCTION:	To provide headset earphone and mike communication between pilot, navigator and operator.

NOTES:

All instrumentation is mounted on a rack bolted in place on the Bell 206A right hand rear seat. All external equipment (tow cables and birds) is attached to the helicopter by means of the cargo hook only.

338

B. GROUND EQUIPMENT

10 KVA Motor 700
Generator

FUNCTION: To provide 400 Hz \pm 10 Hz stable, sine wave current into a ground loop of the order of two miles square 10 KVA alternator used is driven by a mechanically-governed 1600 cc Volkswagen engine.

Matching 60
Transformer

Matches the resistance of the ground loop to the output voltage of the 10 KVA motor generator to obtain the correct current. Primary 240V., 10 KVA. Secondary taps at 400V., 500V., 650V., 800V., 100V., 1500V.

039

C. TEST EQUIPMENT

Oscilloscope		Calibrating Turair; Trouble shooting
SONY 323	7	

Sine Wave Generator		Calibrating Turair; Trouble shooting
H-P 208 A	9	

Voltmeter		
H-P 427 A	4	Trouble Shooting

Decade Resistance	2	Trouble Shooting
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Decade Capacitance	2	Trouble Shooting
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APPENDIX 2

SURVEY EQUIPMENT AND PROCEDURES

SEMI-AIRBORNE ELECTROMAGNETIC SYSTEM - TURAIR-2

APPENDIX 2SURVEY EQUIPMENT AND PROCEDURESSEMI-AIRBORNE ELECTROMAGNETIC SYSTEM - TURAIR-2

In the application of electromagnetic prospecting methods, it has long been recognized that, other things being equal, much greater exploration depths can be attained with systems employing a fixed source than with systems where both source and receiver are moved in unison. This is an extremely important consideration in Australia where surface weathering may extend to considerable depth.

Most present-day airborne electromagnetic (AEM) systems are of the moving source type, and although such systems have tangible advantages over the ground versions, it appears difficult to increase their useful penetration substantially beyond their present range. Under very favourable conditions the better moving source AEM systems may reach exploration depths of as much as 300 ft. or in exceptional cases 370 ft. below the ground surface. This is sufficient for many search problems but in some areas the geologic and topographic conditions necessitate a much deeper penetration to conduct meaningful mineral surveys.

The foregoing considerations have led to the development of the Turair method for the purpose of deep electromagnetic exploration. The system, which can be described as a fixed source, semi-airborne, gradient measuring device, employs a large transmitting loop on the ground as a primary source. The horizontal gradients of amplitude and phase of the vertical magnetic field are measured from the air, along traverse lines across the source and perpendicular to the regional geological strike.

The Turair method, because of its semi-airborne character, is particularly suitable for the detailed, deep investigation of structures having geologically favourable characteristics or a magnetic expression suggesting favourable geology. Because of its potential depth of exploration, it can be employed in areas of deep sedimentary cover, deep weathering, or tall tree cover (tropical area), or in areas where shallower exploration has established the presence of ore deposits and a deeper search is desired. It is, because of its fixed source configuration, less affected by near-surface conduction and can be applied with a very low exciting frequency (e.g. 200 Hz or less). Finally, as a helicopter-borne system it can operate in mountainous topography. Terrain clearance has far less effect on the exploration depth of the Turair system than it has on moving source methods and it can penetrate deep talus cover and valley fillings.

Economic ore deposits may have strike lengths less than 600 ft. If we want to search for such targets, particularly at greater depths, line spacing should not be much greater and for the average survey a line spacing of one-eighth mile should be considered optimum.

EQUIPMENT

The Scintrex Turair-2 is a fixed source, semi-airborne electromagnetic system designed for helicopter operation.

The system embodies a fixed transmitter on the ground and a receiver carried in the helicopter. The size of the transmitting loop is guided by geological conditions and the character of the survey. A typical loop size is a 2 miles x 2 miles square - other shapes and sizes can be used. The loop is usually laid out from a truck or by helicopter. For airborne placement a special dispensing device is used which feeds out continuously, several miles of wire. The primary field of the present system is excited by means of a 15 Kw motor driven generator which supplies a current of 4-10 amperes into

the transmitting loop. The system can operate at 200 or 400 Hz, the selected frequency depending on the geological conditions in the survey area.

The receiver system comprises 2 horizontal coplanar air-cored coils, rigidly mounted 7 feet apart in a "bird". This bird is towed approximately 100 feet below the helicopter by means of a cable which also carries the electrical signals from the bird. In Australia, measurements are normally taken inside the loop. In environments with more resistive surface layers, such as parts of Canada, measurements are also taken outside the loop, thus greatly increasing area that can be surveyed with one loop.

The quantities measured with this dual coil measuring electromagnetic system are the ratio of the field strength and the phase differences of the alternating magnetic field at the two coils. The changes in field strength ratio and phase difference are expressed in percent and degrees respectively, the noise level being less than 0.1 percent and 0.1 degrees. Both parameters are recorded in analogue form.

Flying towards or away from the loop the amplitude of the field detected at the coils changes gradually but considerably. An automatic switch connected to the signal detector amplifier changes so that the amplified output of the preamplifiers is within the signal strength limitations necessary for the equipment operation. These switching markers are sometimes evident on the recorder charts.

At one or more points during each flight, the scale sensitivities and zero levels are checked by means of calibration and zeroing signals respectively. The reference or zero level for each Turair electromagnetic trace is an arbitrary one, and is obtained empirically from the regional level of each section of a trace.

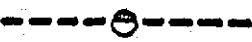
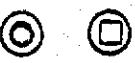
Since the gradients of the signals recorded within about 600 ft. to the loop sides are too strong, it is not possible to distinguish field changes due to conductors of geologic origin lying in these "blind zone" regions.

The field strength ratio and phase difference are recorded in such a way that flying "towards" the wire of loop's side system, a normal anomaly shows a positive sign (i.e. upward deflection), while flying "away" from the wire the sign is reversed. Reversed anomalies can also be the result of particular geometric situation, e.g. when the source is located on the hanging wall side of a flatly dipping conductor. Man-made disturbances including power lines, pipe lines, metal fences, railways, etc. may cause spurious anomalies. The former are recognizable as such when they appear as cyclic noise of irregular shape and phase relationship. Non-energized, grounded power lines (e.g. 3 phase systems) sometimes give rise to anomalies that are more difficult to identify. Such indications as well as those from pipe lines and metal fences, etc. are however, of short duration and can be distinguished from most geologic sources except for very narrow, near-surface conductors. In some instances, ground investigation may be necessary in order to resolve the ambiguity of possible sources. Although the airborne geophysical crew attempts to note visible man-made conductors of the above type, the ground moves by so rapidly at the low flight elevation employed that 100% recognition of such sources cannot always be expected from the air.

The normal terrain clearance of the bird is 100 - 200 ft. depending on the surface topography, tree cover, etc., with the helicopter 100 ft. above.

The established useful depth of the system for moderate-to-large conducting bodies of 1000 ft. in length, is at least 600 ft. sub-bird under conditions of low extraneous geologic noise, i.e. where the general level of conductivity of the overburden and rock types of the area is low.

TABLE II

Coding	Category	Signal/Noise	$\Delta\%/\Delta^{\circ}$ Q	Remarks
	1	>2	>1	Anomaly well defined, good conductivity.
	2	>2	<1	Anomaly well defined, low to medium conductivity.
	3	<2		Anomaly poorly defined, weak. Quantitative determination not possible.
	Conductivity (σ) x thickness (t) of target conductor.		Marked only if Q can be determined with some certainty and no appreciable overburden distortion is present.	
	Subsurface depth (a) to current concentration.		Marked on if a can be determined with sufficient certainty. a is maximum depth, current axis 10-15 m below upper edge of body.	
	Reversed current flow.			
Magnetic Correlation				
	Direct Coincidence			
	Magnetic high off-set to right.			
	Magnetic high off-set to left.			
	Spurious Anomalies		Mainly man-made conductors.	

04

ANALYSES OF STREAM SEDIMENT SAMPLING - E.L. 42/71Key

Samples were sieved into two fractions

top line -10# +85#

bottom line -35#

S.S.I. stream sediment sample number

I.S. insufficient sample

Stream Sediment Sample No.	Assays (p.p.m.)									PH
	Cu	Pb	Zn	Ni	Sn	As	Co	Fe	Mn.	
SS 84	5	<20	15	5	10	<10	5	3700	40	5.5
	20	<20	25	5	50	<10	5	8400	15	
SS 85	10	<20	25	5	<10	<10	5	6300	10	5.5
	25	<20	20	5	25	<10	5	6300	15	
SS 87	5	<20	25	5	25	<10	5	9500	35	5.5
	20	<20	25	5	<10	<10	5	8400	10	
SS 100	5	<20	20	5	<10	<10	5	7400	80	
	10	<20	20	5	<10	<10	5	4200	15	
SS 101	10	<20	15	5	<10	<10	5	10000	500	
	10	<20	20	5	<10	<10	5	6800	260	

047

ANALYSIS OF ROCK SAMPLES E.L. 42/71

contd.

KEY Tr - Trace

Assay Sample No.	Rock No.	Rock Description	Assay %				
			S	Mn	Fe	Mg	Ca
11753	16	Recrystallised Marble	0.83	3.80	26.7	4.13	0.7
11756	1c	galena	0.14				
11754	1d	gossan	0.42				
11755	1e	siderite	11.3	0.42	12.8	7.21	15.
11757	2	gossan	0.10	.045	31.5		
8	3a	siderite	0.10	3.20	36.7	1.32	0.1
9	3b	Carbonate gossan	1.26	0.18	27.2		
11760	3c	gossan		0.07	11.5		
1	9	gossan	0.81	1.30	39.0		
2	31	sulphides					
3	39	siltstone & sulphides					
4	40	" " "					
5	42	Argillite & sulphides					
6	44	siltstone & sulphides	0.81				
7	44a	Marble	0.73	2.80	28.2	4.91	0.4
11770	112	Carbonate	0.07	.085	12.8	9.13	16.
1	115	"		0.04	2.13	2.62	4.8
2	118	tuff and sulphides					
3	120a	shale and sulphides	18.3				
4	120b	" " "	2.03				
5	120c	massive pyrite					
6	126	siltstone & sulphides	3.39				
7	128	carbonate tuff					
11793	291	shale & sulphides	0.96				
4	225a	ankevite marble		2.60	25.7	5.66	0.3
5	228	shale & sulphides	0.10				
11796	247	brecciated shale		0.04	10.8	0.69	0.3
7	248	carbonate & sulphides		.065	9.47	2.21	0.5
8	249	gossan					
9	251	black shale	0.33				
11900	256b	shale & sulphides	1.30				
02401	269	carbonate		0.24	9.00	2.21	3.7
2	277	carbonate		0.09	3.33	1.55	13.1
3	278	chert and sulphides	1.41				
02406	286	limonite gossan	0.33	1.60	13.1		
7	292	shale and pyrite	1.45				
8	268	carbonate tuff	0.54	0.06	11.0	2.88	2.
9	302	banded shale	1.12				
02414	341	shale and sulphides	5.31				
02425	584	" " "	11.3				
GOSSAN SAMPLES							
11719	1d	gossan		0.29	9.62		
20	24	"		0.22	3.15		
21	9	"		0.06	3.20		
22	43	"		0.44	8.15		
23	249	"		11.4	0.95		
11724	286	"		Tr.	5.94		

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ANALYSIS OF ROCK SAMPLES E.L. 42/71

Assay Sample No.	Rock No.	Rock Description	Assay p.p.m.							
			Cu	Pb	Zn	Ni	Sn	As	Co	Ag
11753	1b	Recrystallised Marble	200	11200	11900	15	100	<10		
11756	1c	galena	400	46300	8800	15	<100			17
11754	1d	gossan	100	660	240	15	100			
11755	11e	siderite	<100	200	200	15	200			
11757	2	gossan	100	200	400	15	<100	400		
8	3a	siderite	<100	30	40	15	200			
9	3b	carbonate gossan	500	20	110	15	<100			
11760	3c	gossan	200	70	80	15	500			
1	9	gossan	<100	30	150	65	200	400		
2	31	sulphides	<100	20	140	100	600			
3	39	siltstone & sulphides	100	90	190	70	100	400		
4	40	" " "	200	40	30	15	<100	400		
5	42	Argillite & sulphides	100	70	100	120	100	600		
6	44	siltstone & sulphides	300	100	30	30	500			
7	44a	Marble	200	240	130	30	200			
11770	112	Carbonate	<100	30	30	20	400			
1	115	"	500	30	60	20	<100	300		
2	118	tuff and sulphides	200	30	120	80	<100	300		
3	120a	shale and sulphides	300	150	20	15	200			
4	120b	" " "	<100	<20	10	15	600			
5	120c	massive pyrite	<100	70	20	55	100			
6	126	siltstone & sulphides	<100	240	120	50	500			
7	128	carbonate tuff	100				100	300		
11793	291	shale and sulphides	<100	20	40	10	1200	500		
4	225a	ankevite marble	100	30	60	10	100	400		
5	228	shale and sulphides	<100	20	60	30	900	400		
11796	247	brecciated shale	100	20		60	100	400		
7	248	carbonate & sulphides	200	260	250	70	100	500		
8	249	gossan	<100	3700	1780	20	200	2300		
9	251	black shale	<100	20	10	<10	900	400		
11800	256b	shale and sulphides	100	20	180	70	700	500		
02401	269	carbonate	<100	30	80	80	500	400		
2	277	carbonate	<100	30	70	80	400	400		
3	278	chert and sulphides	100	120	120	170	300	400		
02406	286	limonite gossan	300	30	60	<10	<400	400		
7	292	shale & pyrite	100	240	20	30	800	700		
8	268	carbonate tuff	300	<20	140	220	1100	500		
9	302	banded shale	<100	130	110	30	500	400		
02414	341	shale and sulphides	100	<20	120	60	300	400		
02425	584	" " "	<100	30	140	60	300	400	2.15	
Gossan Samples										
11719	1d	gossan	400	1200	400	Tr.	1700	900	20	
20	24	"	200	50	Tr.	Tr.	600	40	20	
21	9	"	Tr.	40	Tr.	Tr.	500	50	10	
22	43	"	Tr.	10	Tr.	Tr.	600	10	10	
23	249	"	Tr.	500	350	100	800	1500	40	
11724	286	"	100	2100	3000	50	600	70	20	

contd.

APPENDIX 4

Thin Section Descriptions of Rock Samples - E.L. 42/71

Note Co-ordinates refer to Renison Mine Grid.

Rock Sample 1b. Location 20440m N 14565m E Poseidon Mine

H.Sp. Cream coloured, coarsely crystalline carbonate rock, with galena.

TS 11690 This coarsely crystalline carbonate should strictly be termed a marble; the carbonate appears very similar to the Renison material ("sideroplesite"). Small patches and doubly terminated quartz crystals occur throughout (except in carbonate veins). The rock has been fractured, and partly replaced by quartz patches carrying pale sphalerite, galena and manganese-iron-oxides, with minor siderite. The carbonate was determined by XRD to be very similar to Renison No. 2 horizon carbonate, though perhaps closer to siderite in composition.

PS. The sulphides are small pyrite crystals, small (50 μ) and occasional larger (up to 1mm) patches of galena, and pale sphalerite up to 100 μ in size. They are a low temperature hydrothermal replacive phase.

Rock Sample 3b. Location 21076m N 14754m E Dunkleytown

H.Sp. Cellular goethite; boxworks derived from ? carbonate.

TS11656. This is a carbonate gossan, composed of goethite boxworks after fairly coarsely crystalline carbonate, and small quartz veins. Geochemical analysis for base metals and for Sn (and possibly Ti) could be useful.

Rock Sample 5a. Location 21380m N 14710m E Dunkleytown

H.Sp. Fine grained grey brown clastic rock.

TS 11691 This is a fine grained tuff of andesitic-basaltic composition. The main components are fresh small fragments of oligoclase-andesine, augite, magnetite, andesite rock and green glass (some is devitrified), in a fine, almost isotropic matrix of dusty, ashy material. Some carbonate fragments are also present, as well as occasional lenses of ferruginous siltstone. This rock probably belongs to the Crimson Creek Formation.

Rock Sample 6b. Location 21383m N 14705m E Dunkleytown

H.Sp. Dark grey, fine-grained clastic rock.

TS 11657 Essentially a tuff, though with non-pyroclastic components. The rock could well be correlated with the Crimson Creek formation. It consists of small fragments of plagioclase, andesite, carbonate, devitrified glass, vesicular material, and occasional larger pieces of argillaceous, carbonaceous, pyritic siltstone (folded). The matrix/cement is dark, semi-opaque dusty material including clay, carbonaceous matter, very fine pyrite, and probably fine glass.

Rock Sample 10. Location 21900m N 14820m E Pieman River Road

H.Sp. Finely laminated red/grey siltstone.

TS 11692 A uniform ferruginous siltstone, in which less ferruginous streaks (grey) alternate with thicker hematitic layers, though on a microscopic scale the interlayering is very fine and subtle, with small scale falsebedding and graded bedding (becoming more ferruginous with finer grain). The silt grade grains are angular quartz fragments, and some fine plagioclase, with a ferruginous, argillaceous matrix. This rock is most probably a turbidite; the iron oxide is a chemical precipitate, perhaps associated with volcanism.

Rock Sample 11 Location 21690m N 15470m E Dunkleytown Area.

H.Sp. Grey green, fine grained argillaceous rock.

IS 11693. This fine grained chlorite rock is believed to be an altered glassy (vitric) tuff. It consists dominantly of small fragments of semi-isotropic green chloritic material, and angular quartz fragments, with relatively abundant fine leucoxene and leucoxenised ilmenite.

Rock Sample 30 Location 21860m N 14850m E

H.Sp. Greenish brown coarse clastic rock; ? lithic tuff.

IS 11694. This is actually a brecciated tuff, composed of large and small fragments of brown, ferruginous, fine grained tuff set in a chlorite-quartz matrix. The tuff itself is quite similar to 6A, though lacking pyroxene fragments. Occasional tuff fragments contain patches and veins of albite crystals. The rock was brecciated and invaded by veins of chlorite-quartz-sphene.

Rock Sample 33 Location 22115m N 14960m E Crimson Creek.

H.Sp. Fine-grained green, vesicular rock with minor sulphide.

IS 11658. This is a vesicular oligoclase-dolerite (microgabbro) composed of oligoclase laths, interstitial fresh angite, leucoxenised primary oxide opaques, and secondary fine chlorite. The small ovoid to spherical vesicles are filled with chlorite and fine carbonate. Occasional patches of serpentinous material suggest the former presence of olivine. This rock is closely similar to the basic intrusives at Renison (eg S314).

PS. The polished section shows diffuse patches of fine pyrrhotite, traces of chalcopyrite and pyrite. The sulphides have been introduced (ie. they are not of primary magmatic origin) and could thus be significant in a "Renison" context.

Rock Sample 44A Location 21650m N 14260m E Crimson Creek

H.Sp. Cream coloured carbonate rock with fine sulphides.

IS 11695. As in 1B, this rock is strictly a marble, because of its crystallinity. It has a distinctive fabric, and the carbonate shows an unusual texture. Whilst the rock is composed of interlocking carbonate crystals/average 0.5mm in size/, these individually have a microgranular texture and are composed of small (40-50u) carbonate grains; these have recrystallized to the larger patches whilst retaining the relict granular texture. The rock is cut by carbonate-quartz veins, and MnO₂ veinlets penetrate the rock. This carbonate was shown by XRD to be virtually identical with that of sample 1B.

PS. Poikiloblastic pyrite crystals are scattered through the rock, and there are occasional small (<50u) grains of galena.

Rock Sample 44b Location 21650m N 14260m E Crimson Creek

H.Sp. Pale grey chert.

IS 11696. This is a dolomitic chert or cherty dolomite; the proportions of the two minerals vary, but on the whole, dolomite probably dominates. Evidently the two minerals were deposited simultaneously, and small (20u) rhombs of dolomite are embedded in the chert. Vague bedding is present, caused by the layered distribution of carbonate rhombs. Very thin pyrite veinlets cut the rock, and post-date the lithification.

Rock Sample 56 Location 22220m N 14560m E Costcan.

H.Sp. Medium grained green clastic rock.

051

TS 11697. This tuff is essentially a lithic tuff, because rock fragments of volcanic origin are dominant. These are mainly andesitic, though with a variety of fabrics, with basalt, glass and trachytic rocks also represented. The matrix consists of plagioclase, pyroxene, oxide opaques, glass and serpentine. This rock resembles No. 305, and quite possibly correlates with the Crimson Creek formation.

Rock Sample 99 Location 20800m N 15850m E Almost Creek

H.Sp. Medium/fine grained grey clastic rock.

TS 11698. Two rocks are in contact in this specimen. The coarser (older) rock is a fine grained tuff, similar to 6B, composed of plagioclase, glass, chlorite, opaques and dust (ash). The finer rock (younger, judging from the nature of the contact) is probably an ash; it is exceedingly fine and semi-isotropic, and individual components are not recognizable. This is common with ultrafine pyroclastics, which are very prone to alteration.

Rock Sample 117 Location 21690m N 13590m E Success Creek.

H.Sp. Fine-grained laminated sediment.

TS 11660. A micaceous, argillaceous siltstone, with thin carbonaceous partings. The main constituents are subparallel flakes of muscovite and silt-sized quartz grains in a matrix of fine argillaceous material. Occasional fine, detrital zircon and tourmaline grains occur.

Rock Sample 118 Location 21685m N 13420m E Crimson Creek.

H.Sp. Fine-grained grey sediment with slump structures.

TS 11661. A fine grained tuffaceous sediment, showing intra-formational slumping and folding, fine lamination, and some graded bedding in sections. The rock is believed to consist of non-pyroclastic as well as pyroclastic components, with occasional fragments of extrusive igneous rocks and coarser cleavage-fragments of oligoclase, in a very fine, semi-opaque and semi-isotropic matrix (mainly altered fine ash). Leucoxene and fine carbonaceous matter provides colouring. Carbonaceous matter also line veinlets of quartz cutting the rock; these veinlets are themselves cut by later quartz-chalcopyrite-? halloysite veins. This rock could well be correlated with the Argillite Unit at Renison.

Rock Sample 123 Location 21520m N 12860m E Crimson Creek.

H.Sp. Dark brown red fine grained rock with ? xenoliths.

TS 11700. This rock is best regarded as an indurated argillite with included clastic fragments of carbonate rock. The carbonate occurs as small rhombs, cleavage fragments and occasional larger (up to small pebble or grit size) fragments of crystalline carbonate rock (ie. marble). These, and small grains of chert, are embedded in a very fine, lithified ferruginous clay matrix. Carbonate is quite abundant throughout; it originated from the bedded carbonates in the Argillite, then this rock must be younger, perhaps part of the Dundas group.

Rock Sample 225b Location 21815m N 14765m E Murchison Mine.

H.Sp. Grey, medium-grained carbonate rock.

TS 11668. A well-crystallised carbonate rock which strictly should be termed a marble; since the carbonate is "ankerite", it is an ankerite-marble. The fairly large interlocking crystals are separated by thin films of carbonaceous material and manganese oxide. Occasional grains of pyrite, and small detrital grains of quartz and muscovite, are present. They tend to occur in layers.

052

Rock Sample 271 Location 21440m N 14707m E Dunkleytown

H.Sp. Cover, fine grained tuff or tuffaceous sediment

b. Microscopic

This is a fine-grained intermediate to basic tuff with a mixture of lithic, crystal, and vitric components.

Average grain size is 0.1mm., though occasional larger fragments up to 3mm. in size do occur.

The major constituents are small cleavage - fragments of plagioclase (sodic andesine), devitrified basic glass, and small fragments of andesite, tuff, chert, and other rocks. Quartz grains are also present.

Interstitial material consists of fine-grained secondary minerals such as chlorite, a carbonate, epidote and leucoxene.

This rock unit is quite possibly part of the Crimson Creek sequence.

Rock Sample 279 Location 21785m N 14770m E Crimson Creek

H.Sp. Fine grained grey green schistose rock.

IS 11713. This is a fine grained, spotted chloritic slate (or perhaps hornfels) with relict orientated fabric. It consists of numerous irregular patches of pale green isotropic chlorite in an extremely fine grained matrix which is probably tuffaceous, at least in part. Much of the matrix is cloudy, poorly defined and semi isotropic. The chlorite patches may be pseudomorphous, perhaps after glassy material though this is not known. The rock may well be an altered ash; it differs from the tuffs so far described.

Rock Sample 299 Location 21270m N 12775m E Dunkleytown.

H.Sp. Dark, fine grained argillaceous rock.

IS 11715. This is a massive argillite cut by irregular veins of goethite, staining the adjacent rock. It consists of recrystallised clay, as very fine flakes with subparallel orientation. Fine carbonaceous streaks give the rock its dark colour. The rock is quite featureless.

Rock Sample 338 Location 21825m N 24560m E Crimson Creek.

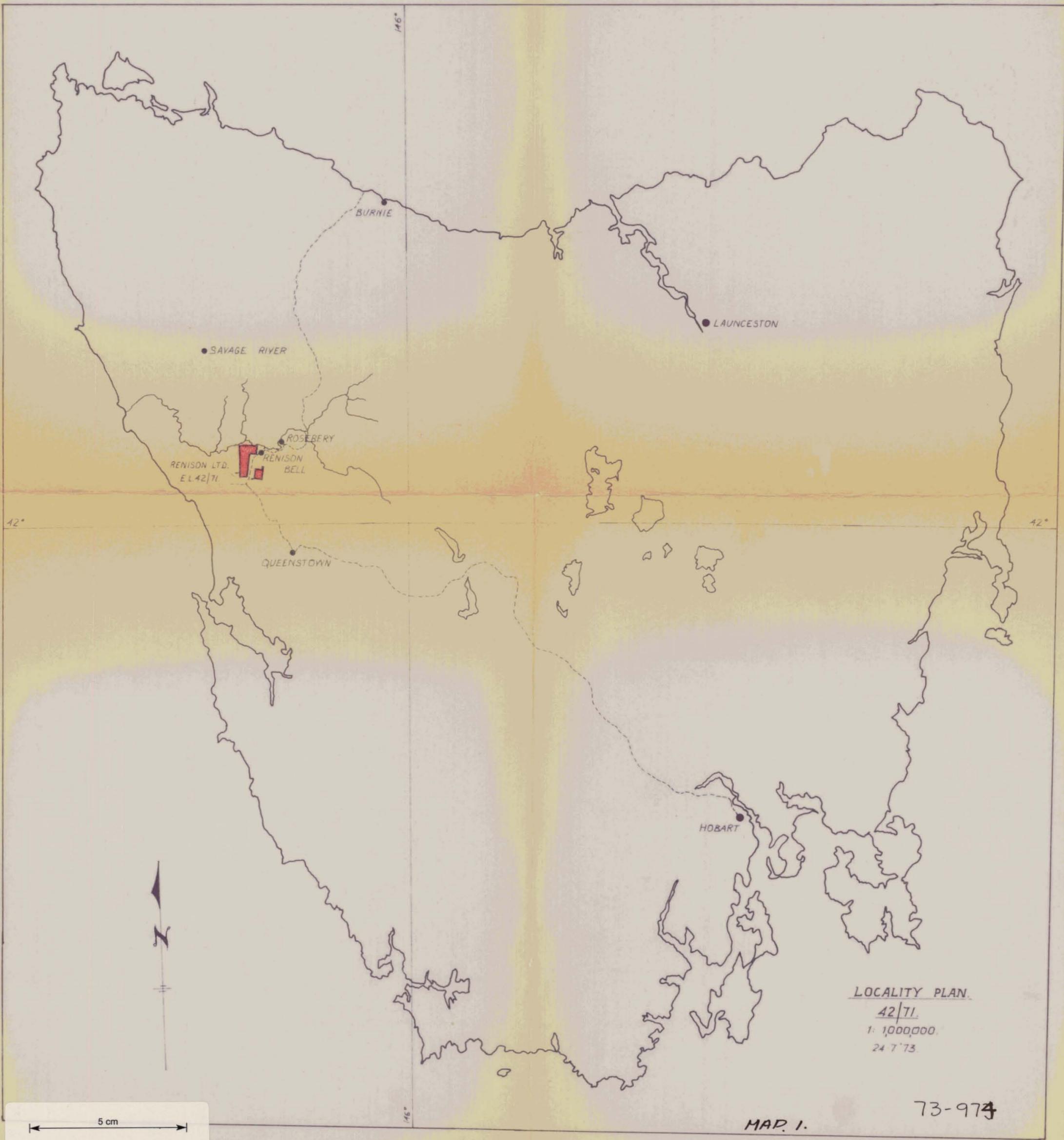
H.Sp. Fine greenish grey shale.

IS 11721. This shale is tuffaceous, however, the proportion of pyroclastic material is difficult to determine with any confidence, since all the components are fine grained and diagenetically altered. The rock consists of silt sized and clay sized particles of quartz, plagioclase, clay, oxide opaques, fine leucoxene, and devitrified glass bedding is quite well developed and is caused by alternating silty and clayey layers. This rock is probably gradational between a tuff and a normal shale.

Rock Sample 361 Location 21425m N 12595m E Crimson Creek.

H.Sp. Dark grey-black fine grained rock with clay pellets.

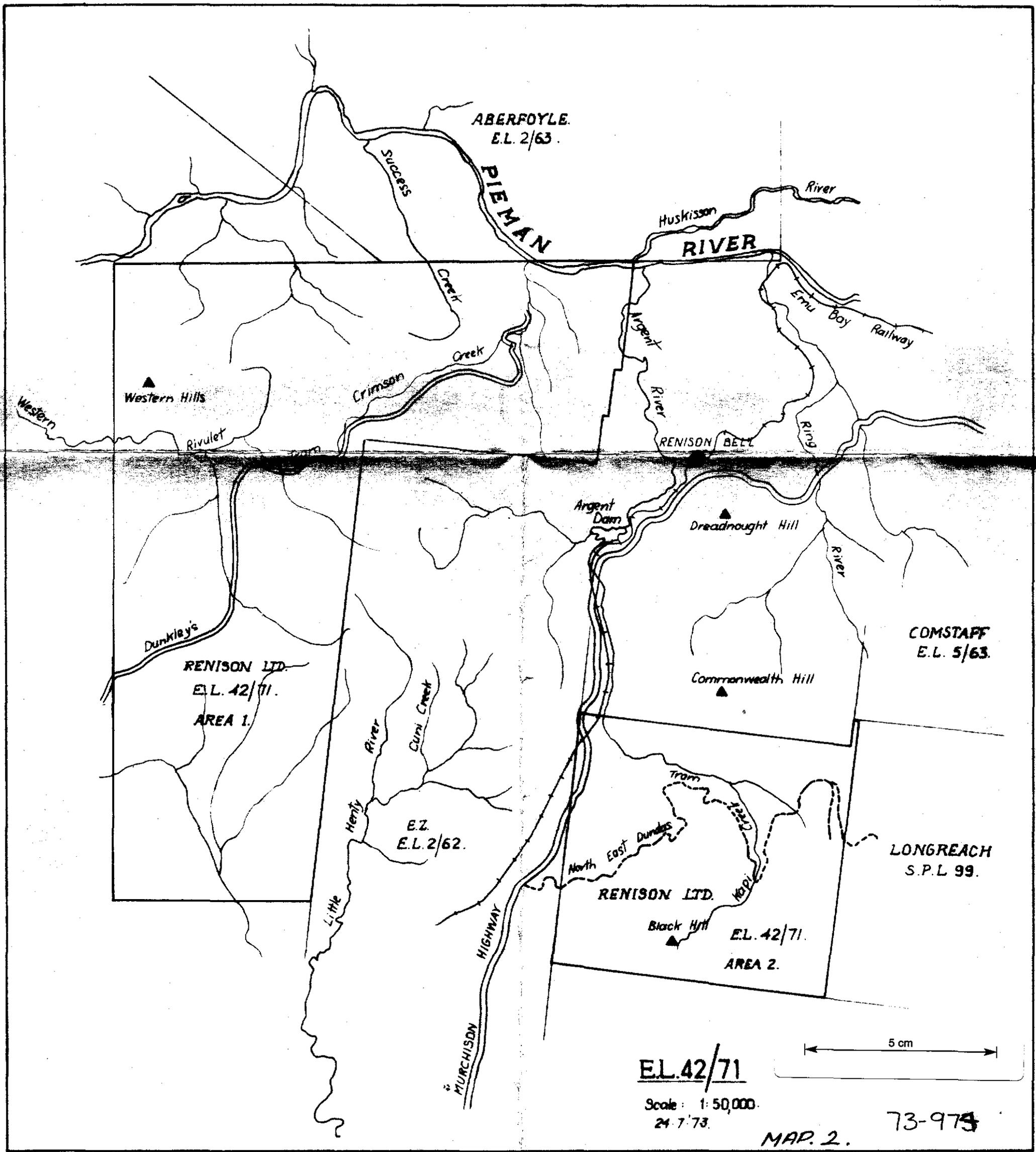
IS 11722. This is a black silty shale, with carbonaceous fragments and clay pellets. It is composed of silt sized grains of quartz and fine muscovite flakes embedded in a carbonaceous clay matrix. Lense shaped clay pellets differing very little from the enclosing rock except for the orientation of the muscovite flakes, are fairly common and there are angular fragments of carbonaceous matter. Some earthy limonite was introduced probably during diagenesis.



LOCALITY PLAN.
 42/71.
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 24 7 '73

MAP. 1.

73-974



ABERFOYLE.
E.L. 2/63.

PIEMAN
RIVER

Huskisson
River

Western Hills

Crimson
Creek

RENISON BELL

Dreadnought Hill

COMSTAFF
E.L. 5/63.

RENISON LTD.
E.L. 42/71.
AREA 1.

Commonwealth Hill

EZ.
E.L. 2/62.

LONGREACH
S.P.L 99.

RENISON LTD.
Black Hill
E.L. 42/71.
AREA 2.

5 cm

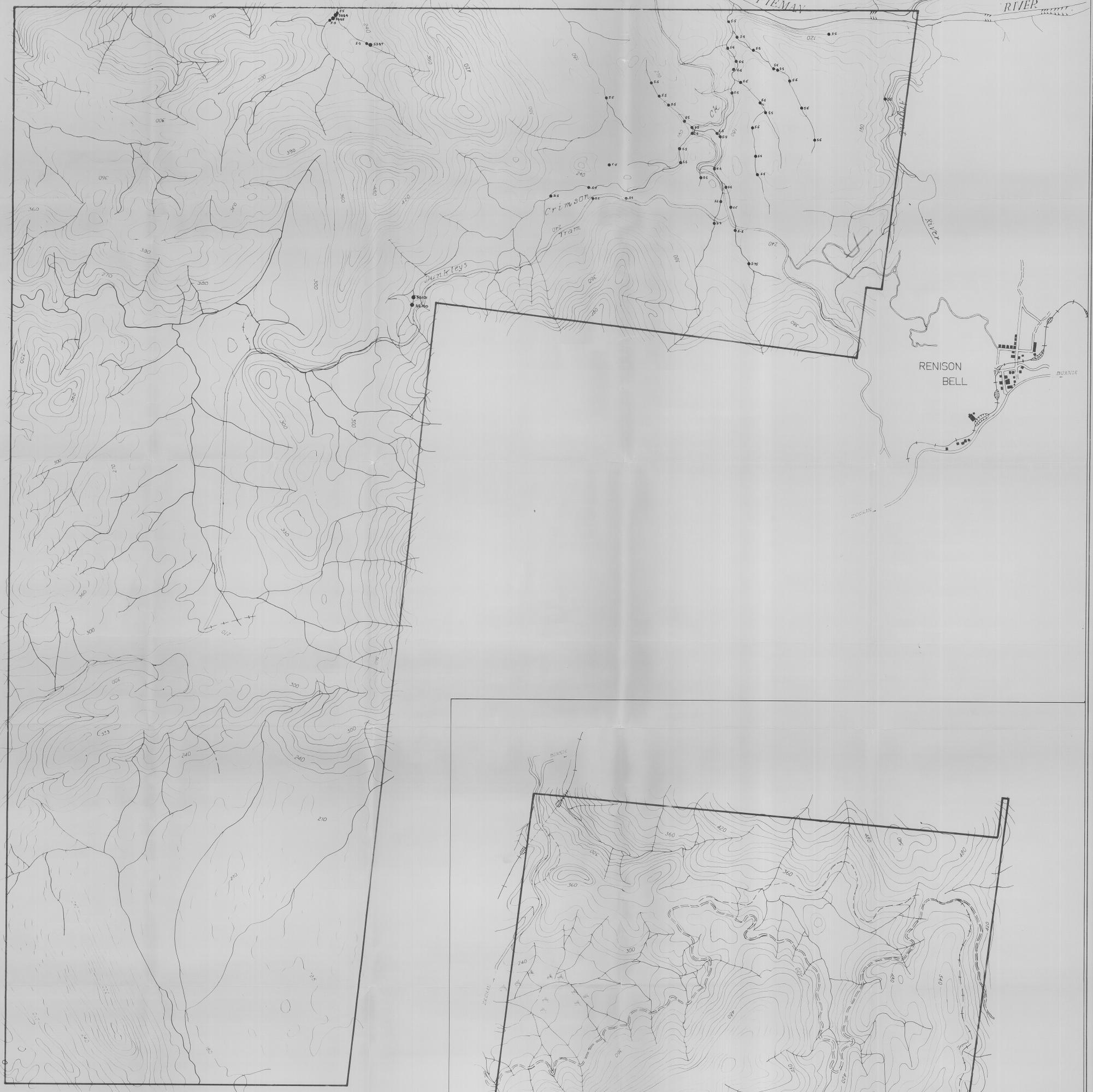
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MAP. 2.

73-975

1439



E.L. 42/71 AREA 1.

E.L. 42/71 AREA 2.

KEY

- Stream sediment sample.
- pH value.
- ▲ Spring Sample.

Cu. 80 Anomalous geochemical values -10+25th fraction (p.p.m.)
 50 -85th fraction (p.p.m.)

Anomalous Streams

- Copper
- Lead
- Zinc
- Nickel
- Tin
- Cobalt
- Arsenic

660057

REVISION LIMITED

E.L. 42/71. 1441

GEOCHEMICAL SAMPLING.

SCALE 1:10000 METRES

DRAWN R.J.P.	TRACED
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1442

KEY
 Tracks
 Grid Line
 Proton Magnetometer reading δ
 (add 60,000 γ)
 Isomagnetic contours

Region 6.2	Section 6.1
Location 6.4	Station 6.3
Zone 6.2	Area 6.4

660055 73-974

RENISON LIMITED

ZEEHAN B2/3

GROUND MAGNETICS 1442

SCALE: 1:5000 METRES

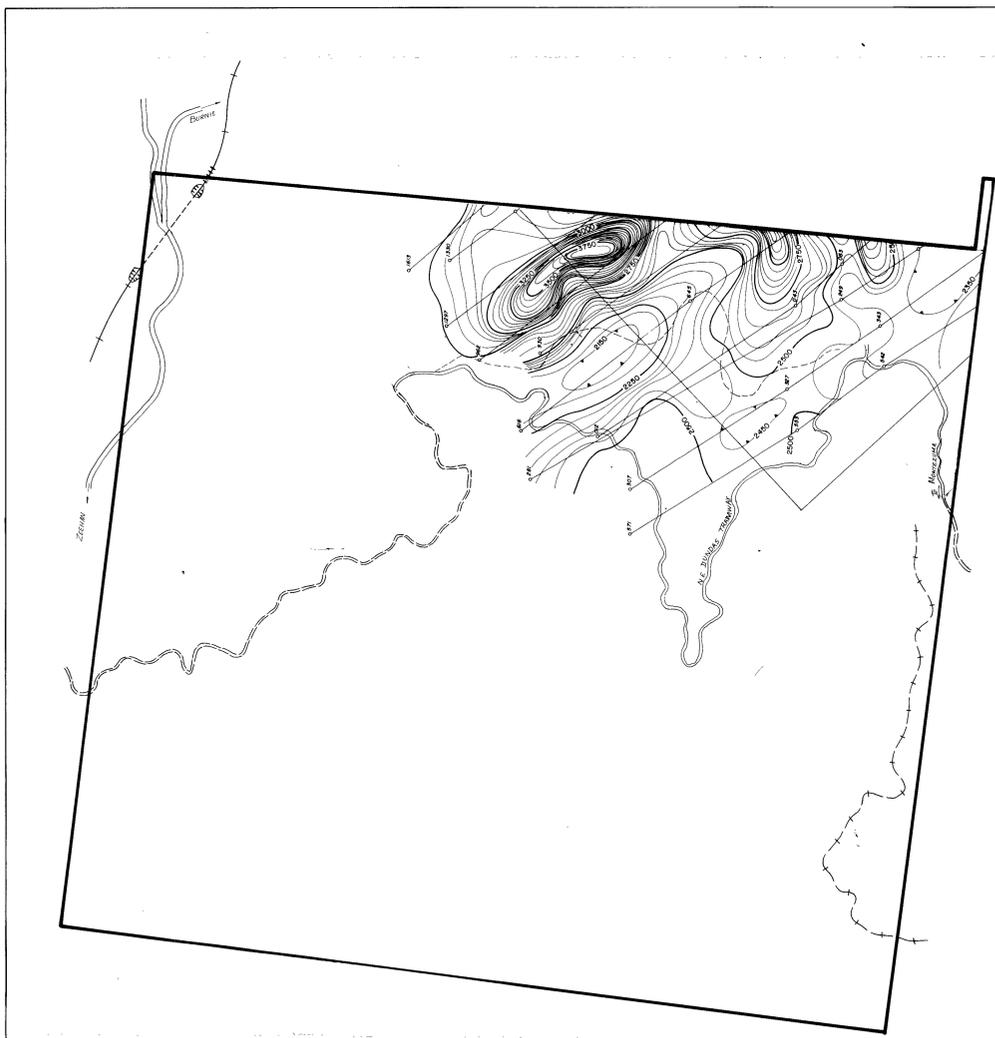
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 DATE 24.7.73
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E.L. 42/71 AREA 1.



E.L. 42/71 AREA 2.

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E.L. 42/71 AREA 1.



E.L. 42/71 AREA 2.

- Fault
- Positive Anis
- Negative Anis
- Limit of Magnetic Unit
- Geological Contact
- Dip

LEGEND

Flight line showing line M and numbered the points

Category 1 - $1 < 100$ MHDS, signal/noise > 2

Category 2 - $10 < 100$ MHDS, signal/noise > 2

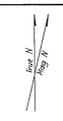
Category 3 - $5 < 10$ MHDS, signal/noise > 2

Anomaly code NP

Depth to current axis in metres/ft in MHDS

- Over maximum of magnetic anomaly
- Near contact showing side of magnetic anomaly
- Standard conductor
- Multiple surface conductors
- Conductor axis and code
- Flat lying conductor or conductive region

NOTE: Turair Survey by Scintrex Pty Ltd Jan 1975
Turair Interpretation by Scintrex Pty Ltd
Air-mag Interpretation by COG



660060		73-9754
RENISON LIMITED		DRAWN
E.L. 42/71		TRACED
1444	DATE	30.2.75
TURAIR & AIR-MAG RESULTS.		SCALE
SCALE: 1:10,000 METRES		DRAWING No.